MEMORANDUM FOR: SEE DISTRIBUTION 30 August 1996

SUBJECT: MRCI Critical Design Review Minutes

1. The Modular Reconfigurable C4I Interface (MRCI) Critical Design Review (CDR) was held on 14 August 1996 at the Ramada Inn in Alexandria, Virginia. The objectives of the meeting were to:

a. Establish the baseline design of the MRCI program.

b. Demonstrate the progress, consistency and technical adequacy of the selected specific design approach.

c. Evaluate compatibility between MRCI system requirements and critical CSCI, CSC, and CSU design.

d. Communicate key aspects and critical task dependencies of MRCI post-CDR schedule.

2. The meeting was convened at 0800; the meeting agenda is provided as Attachment 1. The meeting was co-chaired by Col. Mark Jefferson, Deputy Director Defense Modeling and Simulation Office (DMSO), and by Mr. Tom Tiernan (NRaD), the MRCI Program Manager and agent for DMSO. A complete list of attendees is provided as Attachment 2. An annotated Point of Contact Listing is provided at Attachment 3.

a. Mark Cosby, MRCI contractor, began the meeting by introducing the MRCI CDR Agenda and then had all of the CDR attendees introduce themselves. He then introduced Col. Jefferson who reviewed DMSO's purpose for the MRCI program. Col. Jefferson reviewed the C4I to Simulation operational concept and the benefits that interoperability would provide. He discussed the notional MRCI design and said the STOW experiments were unchanged. Col. Jefferson did announce the addition of a JSIMS Testbed as an MRCI experiment. He listed strawman JSIMS Testbed MRCI issues including: viability of reusable C4I federates in new federations; what do simulation federates need to interact with human in the loop C4I federates; integration of heterogeneous developed federates in an HLA federation; the FOM development process; and how to take advantage of data standards. Col. Jefferson also discussed the current RTI development schedule and the timeline for release of various versions/capabilities.

b. Tom Tiernan briefed the Program Management aspects of MRCI. He provided an updated description of the new MRCI experiments. The following five experiments are planned:

(1) CTAPS to AFSAF
(2) MCS/P & AFATDS to Army SAF & CFOR
(3) CTAPS to the JSIMS „Testbed‰
(4) MCS/P & AFATDS to the JSIMS „Testbed‰, and
(5) MCS/P & AFATDS to CBS.

Note that (1) and (2) are experiments with STOW, as per the original MRCI plan. Experiments (3) and (4) are new. The "JSIMS Testbed‰ contains NASM/AP, Eagle, and NSS. Experiment (5) is a variation on the original experiment with CBS.

c. Mark Cosby then briefed the MRCI CDR background and Program overview for the group.

3. MRCI Design. Mark Cosby introduced Dr. Mike Hieb as the MRCI Design Lead.

a. Identification of MRCI Software Configuration Items, Components & Units. Dr. Hieb briefed the MRCI Hierarchy Description. Dr. Hieb's explanation of the software hierarchy functional diagrams concentrated on the Computer Software Unit (CSU) level of detail. The three MRCI Computer Software Configuration Items (CSCIs): (1) System Specific Interface (SSI); (2) Common Modules (CM); and (3) Runtime Infrastructure (RTI) Interface Module (RIM), were designed to the Module and Sub-Module level to assure design completeness and consistency of interface data, information and command/control transaction specification. The software design is maintained in a Computer-Aided Software Engineering environment which not only captures the design hierarchy, but also generates the functional decomposition and data dictionary information into both linearized and N-squared flow diagrams.

A question was asked about the Control Node used in the exercise. The concern was whether or not the C4I system software on the Control Node would be considered under configuration management. The response from Mark Cosby was that it would not be under configuration management because once the software had been modified to interface with the MRCI, it was no longer considered part of the operational C4I system.

Jonathan Glass, WARSIM, raised another question concerning the MRCI,s level of dependence on the Graphical User Interface (GUI) of the C4I system to configure and operate the MRCI Control Node. Dr. Hieb stated that it was SAIC,s intention to design the MRCI to be configured from a GUI developed for the MRCI. This Control Node GUI would provide access to MRCI functions necessary to instantiate MRCI software and could be part of the C4I GUI or a standalone application. He stated that in the case of C4I systems that do not have a GUI, there would be one created for the MRCI Control Node.

b. Definition of MRCI Software Configuration Items, Components & Units. The CSCIs, CSCs, and CSUs were defined based on the operations they perform. Each was broken down to the module and sub-module level as appropriate. Dr. Mike Hieb then introduced Wendy Holtzman who presented the design of the Communications portion of the MRCI.

Ms Holtzman described how the Communications portion of the MRCI would interface with the Communications of the C4I system and with the rest of the Common Modules. This raised a number of questions. The question was asked if the MRCI would accommodate voice communications. Ms Holtzman stated that at this time MRCI was not addressing it because all messages going to and coming from the RTI would be in CCSIL format. The current design of CCSIL does not support it, but the design of MRCI would accommodate the use of voice inputs in the future via selection of appropriate source object and target object translator templates and bit stream processors within the Common Module CSCI.

This brought up another question concerning the translation of messages. The question was asked why everything was going to be converted to CCSIL before being sent to the RTI. Mark Cosby stated that if the messages were not translated to some common format (e.g. CCSIL because it has some current development and experimentation legacy of success), the simulations in the simulation federates would have to be able to understand many different types of messages.

He further stated that design concepts featuring translation by the receiving simulation would levy new requirements on simulation-RTI interfaces. The levying of new requirements on the simulation federates due to MRCI operations is not permitted in the baseline MRCI requirements specifications from both the Air Force and Army requirements inputs.

The argument supporting translation from the native C4I system language into CCSIL at the simulation(s) is that with this scheme, no translation would be involved for other C4I system federates receiving the message; whereas translation from a native C4I system language into CCSIL by the MRCI requires receiving C4I federates to translate back to the native C4I language. Loss of message intent and/or content would occur in some cases. It was discussed to compare the effects of (1) translation of the C4I messages into CCSIL at the MRCI with (2) translation of the C4I messages into CCSIL upon reception at the simulation. This approach should provide powerful insights into the losses of the translators in terms of message data, information and C2 content and intent which would aid in DMSO future data interchange format efforts.

Ms Holtzman completed her presentation of the Communications portion of the design, and Dr. Hieb continued presenting the remainder of the MRCI software design.

c. Block Diagrams of CSCIs, CSCs, CSUs components & relationships. Dr. Hieb then began presenting Functional Flow Block Diagrams for each of the MRCI CSCIs, CSCs, and CSUs. He began with the SSI. The question of whether or not creating a federation was beyond the scope of the MRCI was asked (This was in reference to the API unit that creates the federation). Dr. Hieb responded by stating that a federation must be created initially by someone, and then the MRCI must join the federation. He then reintroduced Ms Holtzman to present the Communications portion of the MRCI.

As she presented, many questions were asked. Joe Lacetera, CECOM, asked how the MRCI will handle virtual communication systems. He wanted to know how the MRCI will represent communications degradation when the federates (C4I and/or simulation) are using the simulated SINCGARS radio. Mark Cosby responded by stating that he believed those simulations would be separate federates, and not part of the MRCI because simulation is not permitted
within the MRCI. He further stated that SAIC would explore the location of such federation functionality further as part of the experiment test cell implementation and report on the progress in this area at future interim meetings.

Ms Holtzman completed the Communications portion, and Dr. Hieb continued to describe the design. He explained how the Executive would provide the control of the MRCI. He described the Translator and the logic flow processes used to perform the translation. Jonathan Glass asked if the translator could accommodate translations other than to and from CCSIL. Dr. Hieb stated that because the Translator would simply read in mapping and rules files, it could accommodate whatever was required if those files were present.

It was then asked what type of rules would be needed. It was stated that not every data, information or C2 element of a message would be accommodated in one-to-one mappings between C4I messages and a CCSIL „experimental equivalent‰. For example, free text would require some interpretation in order to maintain intent when expressed for processing by a simulation federate. For example, if a free text message states for a unit to achieve a change in

location „quickly‰ , „quickly‰ would need to be interpreted, or otherwise rendered less abstract, as a velocity. Mark Cosby pointed out that this is not a problem unique to the modeling and simulation world. The Army,s current translation from VMF to TACFIRE messages is not „lossless‰ in terms of intent or content. He further stated that the interpretation rules will be available, within MRCI documentation, on the DMSO home page as they are developed. It was also briefly discussed that voice messages offer additional challenges to the MRCI common modules when characteristics such as inflection, amplitude, rate of pronunciation, slurring etc. are introduced as potential „intent indicators‰. Mark mentioned that these topics are fertile ground for developers of MRCI common modules.

d. Program library to contain each CSCI. Mark Cosby then presented a representative MRCI and RTI composite program library/directory structure to be used during MRCI software development.

e. System Specific Interface Design.

-- Common Modules Interface Designs (to SSI & RIM)
-- RTI Interface Module (RIM) Design

Dr. Hieb presented this portion of the presentation by showing the data flow from the SSI through the Common Modules to the RTI Interface Module utilizing N2 charts. Linearized versions were also provided as a separate handout. He then also traced the data flow from the RTI Interface to the SSI. During both the sending and receiving data presentation, Ms Holtzman presented the MRCI Communications portion. At this point in the CDR, the content of the message mapping tables was introduced in some detail to familiarize the audience with the level of specification they should expect on the inter-module interfaces within the Common Modules CSCI.

f. CSCI, CSC, CSU Development Status (i.e. existing or new development). Mark Cosby then discussed the development status of the CSCIs, CSCs, and CSUs. He stated that because of the flexibility of the MRCI design, there are many opportunities for existing software and logic to be reused in the MRCI - particularly in the areas of message translation, system specific interface functions and communications degradation. He said that the design of the MRCI allows for easy upgrades, with minimal risk to the developer of the new module(s) and essentially no risk to the operators of MRCI Control Nodes receiving software upgrades containing the new modules. For example, new translators capitalizing on genetic algorithm-based learning behaviors to maintain intent, need only to be developed compliant with the functionally adjacent interfaces as specified in the intermodule interface specifications, to be plug compatible with MRCI Control Nodes. It is also understood that such new functionality may place additional demands on the data/bit stream processors. Data such as voice inflection, speech rate, and word pronunciation rate may also be required. Such new functionality would be accommodated in other modules of the functional string, again confining changes to specific software locations and minimizing ripples throughout the MRCI software system.

g. Requirements Traceability to SRR. Michael Schlabach from SAIC then presented the traceability of the requirements to the CSCIs, CSCs, and CSUs. He presented a traceability matrix showing that every one of the requirements identified at the System Requirements Review in April has been addressed within the MRCI design.

h. Summary and Wrap Up. Tom Tiernan summarized the CDR issues:

(1) Should native C4I system <--> CCSIL translation occur at the transmit or the receive side of the exchange?

(2) Is a new „database‰ class of interactions required to support exercise generation, database synchronization, inter-C4I system exchange?

(3) Is a simulated C4I system, for example a simulated SINCGARS radio, another federate? Are there issues here for MRCI and live C4I systems?

(4) Is the C4I source code required for the MRCI control node? Can the MRCI get to the databases required through libraries, etc.? (It was noted that the control node is currently overscoped.)

(5) The semantics issue of the inconsistency of calling the top layer of the MRCI the System Specific Interface (SSI) and the bottom layer the Runtime Infrastructure Interface Modules (RIM) was raised. Either both layers should be called „interface‰ or both should be called „interface modules.‰

i. A "show-of-hand" evaluation of how well the MRCI CDR met participants' expectations was as follows:

-- MRCI CDR met my expectations:80%
-- MRCI CDR did not meet my expectations:2%
-- Did not vote:18%

4. Tom Tiernan then wrapped up the meeting stating that there would be a formal In-Progress Review (IPR) in the November time frame. Tom also offered an informal session at the DIS Workshop in September. Mark Cosby recommended that this session be part of the presentations made at the Live C4I-Simulation SubGroup which he chairs.

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